IN THE SPECIFICATION:

Please amend the paragraph starting at page 1, line 6 as follows:

--The present invention relates to an exposure apparatus used in a semiconductor manufacturing process ~~proceeds~~, and more particularly, to an exposure apparatus with extreme ultraviolet light as an exposure light source and a reflection mirror apparatus used in a reflection optical system of the exposure apparatus. --.

Please amend the paragraph starting at page 3, line 3 as follows:

--On the other hand, in a projection optical system mirror provided in the reduced projection optical system, an illumination system mirror, and a light source mirror provided in the exposure-light introduction optical system, the accuracy of form of the reflection surface (hereinbelow, referred to as "accuracy of surface form") must be 1 nm or smaller. Accordingly, as apparent from the above description, the extremely high accuracy of the surface form of about 1 nm cannot be ensured due to displacement of the mirror reflection surface by heat. --

Please amend the paragraph starting at page 3, line 14 as follows:

--In the case of the projection optical system, the above degradation of the accuracy of the surface form in the mirror causes degradation of image formation performance and illumination on the wafer. For example, in the case of the illumination system mirror, the degradation of accuracy of the surface form causes a reduction of illumination and degradation of illumination evenness in the exposure light to a mask. Further, in the case of

the optical source mirror, the degradation of the accuracy of the surface form causes degradation of illumination due to poor focusing of the light source. Such degradation causes degradation of basic performance of the exposure apparatus, such as degradation of exposure accuracy and throughput. --

Please amend the paragraph starting at page 4, line 1 as follows:

--Accordingly, it is desired to suppress a temperature rise of the mirror used in the reflection optical system of the exposure apparatus and to maintain the accuracy of the surface form of the mirror reflection surface. --

Please amend the paragraph starting at page 4, line 19 as follows:

--According to another aspect of the present invention, there is provided an exposure apparatus which utilizes the above reflection mirror apparatus for its reflection optical system. Furthermore, ~~Further more,~~ according to another aspect of the present invention, there is provided a device manufacturing method for forming a circuit pattern on a semiconductor substrate by using the above exposure apparatus.--

Please amend the paragraph starting at page 7, line 1 as follows:

--FIG. 1 is a schematic cross-sectional view showing the structure of an exposure apparatus according to a first embodiment of the present invention. In FIG. 1, reference numeral 1 denotes an excitation laser. The laser is emitted toward a point where a light source material is gasified, liquefied or spray-gasified, as a light emission point of light

source, for plasma excitation of atoms of the light source material, thereby emitting extreme ultraviolet light ~~is emitted~~. In the present embodiment, a YAG solid laser or the like is used as the excitation laser. --

Please amend the paragraph starting at page 7, line 12 as follows:

--Numeral 2 denotes a light source unit having a structure in which a vacuum status is maintained. FIGS. 2A and 2B show the internal structure of the light source unit 2. Numeral 2b denotes a light source indicating an actual light emission point of exposure light source. Numeral 2a denotes a light source mirror which gathers all the light from the light source 2b and reflects the light in a light emission direction, thus generating ~~generates~~ exposure light 2d. The light source mirror 2a is provided as a semispherical mirror with the light source 2b in the central position. Numeral 2e denotes a nozzle which supplies liquefied light emission element Xe, spray-liquefied light emission element Xe or Xe gas to the position of the light source 2b. --

Please amend the paragraph starting at page 7, line 27 as follows:

--Numeral 3 denotes a vacuum chamber accommodating the entire exposure apparatus. Numeral 4 denotes a vacuum pump which evacuates the vacuum chamber 3 thereby maintaining ~~maintains~~ the vacuum status. Numeral 5 denotes an exposure light introduction unit which introduces and shapes the exposure light from the light source unit 2. The exposure light introduction unit 5 having mirrors 5a to 5d homogenizes and shapes the exposure light. --

Please amend the paragraph starting at page 10, line 3 as follows:

--Numeral 14 denotes a reticle alignment unit having a rotation hand rotatable about XYZ and Z axes. The reticle alignment unit 14 receives the original plate 6a from the reticle changer 13, and 180° rotate-conveys the reticle such that an alignment mark in the original plate 6a comes within the view of a reticle alignment scope 15 provided at the end of the reticle stage 6. Then the original plate 6a is slightly moved in XYZ-axis rotation directions with respect to the alignment mark 15a with reference to the reduced projection mirror optical system 7, thus performing alignment ~~the alignment is made~~. That is, the alignment mark in the original plate 6a is aligned with the alignment mark 15a by slightly moving the original plate 6a in the XY shift direction and z-axis rotation direction. In this manner, when the original plate 6a is fixed on the reticle stage 6, the original plate is aligned with reference to the projection system. The aligned original plate 6a is chucked onto the reticle stage 6. --

Please amend the paragraph starting at page 11, line 24 as follows:

--The mirrors 5a to 5d of the exposure light introduction unit 5 ~~to~~ introduce and shape the exposure light from the light source unit 2 and the mirrors 7a to 7e of the reduced projection system 7 respectively have a reflection surface obtained by forming an Mo--Si multilayer film by vapor deposition or sputtering, and reflect the exposure light from the light source with the reflection surfaces. At this time, the reflectivity of the mirror reflection surface is about 70% and the residual light is absorbed in the mirror base material and converted to heat. As a result, as described with reference to FIGS. 11A and

11B, in the exposure light reflection area, the temperature rises about +10 to 20° C. Due to this temperature rise, even if a mirror material with a extremely small thermal expansion coefficient is used, about 50 to 100 nm displacement occurs in the mirror peripheral portion of the reflection surface. Accordingly, the accuracy of the surface form of the respective mirrors cannot be ensured in the light source unit 2, the exposure light introduction unit 5 and the reduced projection mirror optical system 7 in which ~~the~~ extremely high accuracy of the surface form of about 1 nm is required. --

Please amend the paragraph starting at page 12, line 20 as follows:

--In the case of the projection optical system, the degradation of the accuracy of the surface form of the mirrors causes degradation of image formation performance and illumination on the wafer, and causes reduction of illumination and degradation of illumination evenness in the exposure light to a mask by the exposure light introduction unit 5. Further, in a case where the accuracy of the surface form of the light source mirror 2a is degraded in the light source unit 2, focusing of the light source becomes poor, and the illumination is degraded. --

Please amend the paragraph starting at page 13, line 4 as follows:

--In the present embodiment, to solve the problems due to the temperature rise in the mirrors, a mirror cooling mechanism is provided to suppress the temperature rise in the mirrors so as to maintain the accuracy of the surface form of the mirrors. Note that as the form of mirror differs in respective portions, the cooling mechanism for a cylindrical

concave mirror is shown as a representative cooling mechanism. That is, the respective mirrors in the light source unit 2, the exposure light introduction unit 5 and the reduced projection mirror optical system 7 are provided with a cooling mechanism to be described below. --

Please amend the paragraph starting at page 16, line 9 as follows:

--Further, the coolant temperature control unit 28 predicts a coolant temperature to control the temperatures of the coolant for the respective radiation plates so as to control the mirror temperature to a target temperature (e.g. 23°C.), and controls the temperatures of the coolant. The temperature control is performed by e.g.,detecting a change in the mirror temperature and performing feed-forward control on the liquid temperature. Further, the control values are obtained as follows.

(1) The mirror temperature is measured by the mirror temperature detection unit 27, and the exit-side temperature of the mirror coolant is measured by the liquid temperature detection unit 26.

(2) The temperature change amounts in the mirror and coolant and the change rate (change amount of mirror temperature or coolant temperature per time) are calculated from the result of measurement in (1).

(3) A cooling speed necessary to control the mirror temperature to a target temperature within a target time is obtained based on the result of calculation in (2), a temperature set for the supplied coolant (supplied cooling medium temperature) is determined based on the cooling speed, and the change rate is calculated.

(4) A temperature command value for the coolant in the coolant temperature control unit 28 is determined based on the temperature and the change rate obtained in (3).

(5) (1) to (4) are performed in a ~~real time~~ real-time manner. --

Please amend the paragraph starting at page 17, line 10 as follows:

--Note that as the information on the exposure/light amount control, upon a determination of the temperature command value in (4), a predicated value of temperature change corresponding to an increment of the exposure light amount is added in the form of a correction coefficient. --

Please amend the paragraph starting at page 17, line 16 as follows:

--The coolant 24a to 24e controlled to the target temperatures by the coolant temperature control unit 28 flow through the cooling pipes 23a to 23e, thereby cooling ~~cool~~ the radiation plates 25a to 25e to appropriate temperatures. Thus, the mirror 30 is radiation-cooled by the difference between the surface temperatures of the radiation plates 25a to 25e provided in positions near the mirror 30 and away from the exposure-light reflection portion, and the surface temperature of the mirror 30. --

Please amend the paragraph starting at page 17, line 26 as follows:

--FIGS. 5A and 5B are explanatory views showing the temperature distribution on the mirror surface in a temperature control status by the radiation plates 25a to 25e. The coolant 24a to 24e to flow through the cooling pipes 23a to 23e ~~are~~ is controlled to

respectively ~~optimized~~ optimize the temperature by the coolant temperature control unit 28. In the example of the figures, the liquid temperatures of the coolant 24a and ~~24 b~~ 24b are set to about 5° C.; the liquid temperatures of the coolant 24c and 24d~~;~~ are set to about 10° C.; and the liquid ~~temperatures~~ temperature of the coolant 24e~~;~~ is set to about 15° C. --

Please amend the paragraph starting at page 18, line 10 as follows:

--In this manner, as the coolant 24a to 24e at respectively optimized liquid temperatures ~~flow~~ flows through the radiation plates 25a to 25e, the temperature rise is suppressed to about +2° C. in the high temperature portion of the exposure light reflection area. The temperature rise in this case is greatly suppressed in comparison with the conventional temperature rise of +10° to 20°. C. Further, in the temperature of the rear surface of the mirror, the temperature rise is greatly suppressed to about +1° C. in comparison with the conventional temperature rise of +5° to 3° C. As a result, the temperature rise of the entire mirror is suppressed within 1° to 2° C. The thermal distortion is reduced, and the accuracy of the surface form is stabilized to 1 nm or smaller. --

Please amend the paragraph starting at page 22, line 19 as follows:

--According to the above-described respective embodiments, plural temperature-controlled radiation plates are separately provided in positions slightly away from the outer periphery of plural reflection mirrors so as to radiation-cool the mirrors in a non-contact state ~~status~~. In this arrangement, cooling of the mirrors can be performed without the application of a load or distortion to the mirrors. That is, the entire mirror can

be efficiently and uniformly controlled at a predetermined temperature without distortion in the mirror reflection surface. As a result, the degradation of the accuracy of the mirror surface form can be prevented. In the projection optical system (reduced projection mirror optical system 7), the degradation of image formation performance and illumination to a wafer can be prevented. In the illumination system (exposure light introduction unit 5), the degradation of illumination and illumination evenness to a mask can be prevented. In the light source mirror (light source unit 2), the degradation of illumination due to poor focusing of light source or the like can be prevented. These advantages improve the basic performance, such as exposure accuracy and throughput of the exposure apparatus. --

Please amend the paragraph starting at page 26, line 14 as follows:

--As described above, according to the present invention, the temperature rise of a mirror used in a reflection optical system of an exposure apparatus can be suppressed, and the accuracy of the surface form of the mirror reflection surface can be maintained. --